



Effects of Photodynamic Therapy in the Treatment of Mild to Moderate Acne Vulgaris

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Abstract: Acne vulgaris is one of the most common skin diseases in puberty. occurs in varying degrees almost 90% of girls and 100% of boys. Currently, phototherapy, in particular photodynamic therapy, has been used to treat acne vulgaris. The mechanism of action in photodynamic therapy is based on the selective destruction of cells as a result of a light-activated chemical reaction. The data on the treatment of 25 patients with moderate acne with the use of photodynamic and systemic antibiotic therapy (doxycycline) in combination with external means (salicylic acid). Significant improvement was achieved in 90% of patients. Our research shows that photodynamic treatment of acne vulgaris is one of the safest and most effective acne treatments.

Key words: pathogenesis; phototherapy; photodynamic therapy; doxycycline; salicylic acid; methylaminolevulinate.

RESUME: Polymorphous acne is a multifactorial disease, which is caused by the damage of sebaceous glands and follicles on the skin. 80% of teenagers and middle-aged people get this disease. The disease is characterized by seborrhea, formed comedone, inflammatory acne, abscess, pseudocyst and scar [1.3.5.7.10] Acne vulgaris is one of the most common skin diseases in puberty. occurs in varying degrees almost 90% of girls and 100% of boys. Peak incidence is usually associated with age 15–16 years old. It is most often detected at the age from 12 to 24 years old, after 25 years 8-10% of people face this problem, and after 35 years - 3%. In young people, due to anatomical and physiological features the disease is more severe and widespread character [1.3.5].

The development and course of dermatosis largely depends on genetic predisposition, type and color skin, national features.

Studies by D. Fanta [1] showed that the probability of developing severe, long-term, torpid forms of the disease is about 50%, if both parents had it.

The study of the distribution according to the severity of the course of dermatosis among different populations indicates the ethnic characteristics of the disease. It less often develops and proceeds in a milder form in Japanese and Chinese, while the Caucasian peoples there is a high frequency of occurrence and more severe course of the disease [4.6.8.10.12].

- Androgenic hyperstimulation of sebaceous gland function and/or hypersensitivity sebaceous glands to androgens, which leads to increased production and changes in the composition of sebum. Hyperandrogenism has a stimulating effect on the sebaceous glands, increasing the volume sebum, in which the concentration is reduced essential α -linolenic acid - the main regulator of differentiation of keratinocytes of the proto-sebaceous hair follicle (PSF). In the end This eventually leads to follicular hyperkeratosis and closure of PSF with the formation of open and closed comedones, depending on the level of obturation SVF.
- Follicular hyperkeratosis leads to blockage of the excretory duct of the sebaceous gland, while normal evacuation of sebum is disturbed and conditions are created for the growth of *Propionibacterium acnes*, less often *R. granulosum*, *Staphylococcus epidermidis*, etc. There are 66 strains of *Pacnes*. Of these, in the pores of the skin of patients with acne, 2 strains of bacteria predominate - RT4 and RT5, and in the skin of healthy people - RT6. This "good" strain has genes that allow you to fight bacteria, viruses and other infectious agents. Counts, that it is also capable of inhibiting the growth of RT4 strains and RT5, protecting the skin from acne.
- The above pathogens produce the lipase enzyme, which breaks down diacyl and triacylglycerides to glycerol and free fatty acids. These substances, along with antigens of microorganisms attract neutrophils and phagocytes from peripheral blood, producing interleukins - IL-1 α , IL-1 β and IL-8, tumor necrosis factor - TNF α . Pro-inflammatory cytokines activate the enzyme cyclooxygenase, which promotes the formation of arachidonic acids of the main inflammatory mediator - LTV4. It, in turn, stimulates the release of hydrolytic enzymes and nitrogen monoxide from neutrophils, T-lymphocytes, monocytes and eosinophils, which leads to the destruction of the wall of the sebaceous glands with the release of its contents into the dermis and the development of an inflammatory reaction in the form of papulopustular and nodular cystic elements. [4.7.10].

In addition, pathogenic microorganisms, in particular *Propionbacteriumacnes*, secrete lipases, proteases, hyaluronidase, which break down lipids. with the release of a large amount of free fatty acids (FFA), as a result of which, normally, the slightly acidic pH of the skin shifts to the alkaline side, which leads to a decrease in bacteriostatic properties sebum. Altered sebum composition also has irritating properties, therefore, in places of increased sebum secretion, the skin often reacts with the appearance of inflammatory hyperemic spots and peeling - the development of seborrheic dermatitis [3.8.9].

The most common is the papulopustular form of the disease - in 70–80% of patients, and one of the severe manifestations is acne conglobata, which occur in 10–15% of patients [2.5.6].

The question of effective treatment of the disease before still remains relevant. Modern approaches to treatment include the appointment of various systemic and topical preparations, physiotherapeutic and cosmetological methods that affect on the main pathogenetic links of dermatosis, and also on the manifestations of post-acne. The choice of therapy should be based on an adequate clinical assessment of the severity of the disease. It is also necessary take into account the age, sex of patients, the results of laboratory and instrumental data, the presence of concomitant diseases, the experience of previous treatment.

Currently for the treatment of acne vulgaris widely used methods of phototherapy, one of the which is photodynamic therapy (PDT).

The mechanism of action of PDT is based on selective cell destruction as a result of light-activated chemical reaction. The reaction is carried out in the presence of a photosensitizer whose wavelength corresponds to the absorption peak of the photosensitive substance [10.11.12].

There are a large number of photosensitivity congestion, but only a few of them are used in dermatological practice. An ideal photosensitizer is characterized by low dark toxicity, is more quickly captured by pathologically altered tissues, and is quickly removed from normal tissues, produces large amounts of cytotoxic product [7.9.10].

The main photosensitizers for treatment skin diseases are derivatives of aminolevulinic acid (ALA).

The activation of tissue destruction mechanisms occurs due to the effect of the light source on protoporphyrin IX. The first type of reaction is carried out due to the formation of singlet forms of oxygen and the generation of thermal energy. The second type of reaction leads to the emergence of triplet molecules that are capable of directly producing cytotoxic photodynamic effects. It is known that one of the main links in the pathogenesis of acne is a bacterial factor. *P.acnes* are able to produce their own endogenous coproporphyrin. Thus, during PDT with ALA, the photosensitizer is synthesized protoporphyrin IX and endogenous coproporphyrin, which gives bactericidal and cytotoxic effect [5.6.10].

Materials and methods We observed 25 patients (15 women and 10 men) aged 16 to 28 years with acne vulgaris (acne) of moderate degree gravity. The duration of the illness was from 2–8 years old.

The 1st group included 7 people (5 women, 2 men) with moderate disease severity received basic therapy (doxycycline and salicylic acid) and PDT with photosensitizer Alasens (SSC NIOPIK, Moscow) according to the method once a week 4-5 procedures.

Group 2 included 6 patients (5 women, 1 man) with moderate severity of the disease, who also received basic therapy and PDT with photosensitizer Metwix (Galderma, France) according to the scheme once a week with a course of 4-5 procedures.

The control group consisted of 7 patients (5 women, 2 men) with moderate disease severity, receiving only basic therapy.

We tested several samples of ALA at various concentrations, 16% methylamino vulinate, and various incubation regimens. Best the effect was noted when using 20% of the drug Alasens and 16% of Metwix, while the incubation time was 60 minutes, the exposure time was 20 minutes.

The photosensitizer was applied to the cleansed skin under an occlusive film. Procedure were performed once a week with a course of 4–5 procedures. Tetracycline antibiotics (doxycycline) was prescribed according to the scheme of 100 mg, 1 tablet 2 times a day. From external therapy used azelaic acid in the form of a gel or cream. During PDT, all patients received photoprotective agents (SPF50+). Efficiency was assessed by quantitative counting papulo-pustular elements:

- clinical recovery was recorded at complete regression of elements;
- significant improvement – with a regression of at least 75% elements;
- improvement - with the resolution of the elements of the rash, no less than 50%;
- lack of effect from the procedures.



Rice. 1. Patient R. Acne vulgaris of moderate degree gravity.

a – before treatment; b - after the 4th procedure on the Photodyn750 device 20%

RESULT AND DISCUSSIONS As a result of the use of PDT in each group

2 (16.4%) patient had a clinical recovery, 4 (51%) had a significant improvement in the process, 3 (32%) had an improvement in the process, 2 (16.4%)

the effectiveness of the technique was low (Fig. 1).

On average, the effectiveness of PDT with drugs Alasens 20% and Metwix 16% were equivalent. The tolerability of the procedure was generally good. All patients in the first 2 days worried hyperemia, in the future - slight peeling. Of all patients, 1 patient had the appearance of hyperpigmentation caused by non-compliance with the regimen, namely the non-use of sunscreens.

In patients in the control group who received only doxycycline and external therapy, the following results were obtained: clinical recovery – 0%, significant improvement – in 1 (16%), process improvement – in 2 (33%), efficiency in 3 (50%) after a month of therapy was low.

Thus, combined treatment, including PDT using broad-spectrum visible light and infrared light transmitted filtration through a water filter in combination with photosensitizers from the group of porphyrins, is a highly effective and safe method treatment of acne vulgaris.

The best results were obtained with complex therapy using PDT and systemic antibiotic therapy in combination with external agents.

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